THE BROWN ARGUS BUTTERFLY: HYBRIDS OR NO HYBRIDS

BILL SMYLLIE

164 Dobcroft Road, Sheffield S11 9LH.

Introduction

A PAPER ON THE above butterfly (Shreeve, 1993) is entitled "Confusing the geographic variation within species of *Aricia* for hybridisation". Referring to the major factor of lunulation (though this is not specifically mentioned), Shreeve maintains that variation "is interpreted in relation to past events (Smyllie, 1992a) . . . but can be more readily explained as adjustments to current conditions (Dennis and Shreeve, 1989)". There is however in this criticism no distinction between the lunulation data generated and any attempt at an explanation. "Current conditions" mentioned above refers to a time-band of say 1000 years which is short in relation to the period since the last ice-age. Data on upper forewing lunulation has been generated largely from museum collections which span the last 70 years or less, together with photographs and field checks in the last five years. There is no evidence of inconsistencies during this time-band, which is the present as far as geological time is concerned. These data are quite independent of any theory or theories which purport to explain the position, whether they are finally seen to be correct or incorrect. Facts as they are today are recorded, not the position as it might have been at some time in the past, not as it might be at some time in the future. Whether the *Aricia* in Britain and further afield can be considered a range of hybrids, or whether the present species and sub-species adequately cover the situation as Shreeve maintains will be determined by the accumulation of suitable relevant facts.

In Shreeve's comments there is no mention of what might be called phased emergence, where lunulation starts high and decreases through the flight period. This phenomenon is a present fact, and in view of its importance four examples will be mentioned out of several possibilities.

"Adjustments to current conditions" as postulated by Dennis and Shreeve are accepted as a general principle, although there are difficulties with the Brown Argus in England thrown up by lunulation data which will be mentioned below. Lastly the status of *artaxerxes, salmacis* and *agestis* is discussed briefly.

Phased Emergence

1. Although in cross-breeding experiments larvae were normally reared in continuous light (Jarvis, 1969), details of growth under normal conditions were given in an experiment where Reading (*agestis*) females were back-crossed with second generations hybrid males via Sherburn (*salmacis*) males and Reading females. The resulting larvae showed variation from

agestis colouring at one end of the spectrum leading to pupation before the winter, to diapause in more than one instar where increasing *allous* features coincided with slower development. The scene is set here for butterflies with *agestis* lunulation, *ie* well lunulated ones, preceding others with increasing *allous* features, *ie* reduced lunulation, during next year's flight period.

2. Lunulation reduction later in the flight period was noted in the field at Watlington Hill in the Chilterns in 1989, a bivoltine *agestis* colony.
3. Regular field checks during 1992 confirmed that during the flight period at a univoltine Peak District site lunulation gradually drifted downwards (Smyllie, 1993).
4. A similar but more widespread variation is recorded for Sandhammeren, South Sweden (Høegh-Guldberg, 1966) where there is a bivoltine emergence sandwiching a poorly lunulated univoltine one. The bivoltine is however not as well lunulated as *agestis,* and the total lunulation figures are similar to the Durham coast (Smyllie, 1995).

The above four examples, which include a cross-breeding example, indicate a link between lunulation variation between individuals and different emergence times which in turn are related to inputs from different ancestors in the more remote past.

Geographic Variation

"Adjustments to current conditions" as postulated by Dennis and Shreeve seem reasonable. This is a general theory which does not have to take specific data into account: there are however difficulties when lunulation data is examined for the Brown Argus in England. The lunulation characteristics of the Peak District (Smyllie, 1992a) and subsequently the Yorkshire Wolds (Smyllie, 1992b) show that the colonies there are *agestis.* Both are univoltine – the climate has presumably deteriorated to cause the change from bivoltine, and yet there has been no perceptible change in lunulation due to total site aspects. If there had been this would have reflected in an increased percentage of lower or 0-lunule specimens, particularly since at Grassington, due west of the Yorkshire Wolds and no higher than the Peak District, the 0-lunule male component is as high as 30%. It is perhaps pertinent to mention in this context that at Coombs Dale in the Peak District, the colony there has responded to the excellent weather in July and August 1995 by producing a significant second brood: so also has the Common Blue.

With the exception of lunulation at the start of the change from *agestis* (at Pickering, North Yorkshire and Perthichwareu, North Wales) Durham has two extremes in lunulation. At Hart Warren (CC: CP=0.15 Smyllie, 1992a), lunulation is by far the lowest in England. This ratio – Combined *Crassilunulata*: Combined *Parvilunulata* is obtained by combining 50% of

male and female lunule figures where male C have 5 or 6, male P have 0-4; female C have 6, female P 0-5. It gives a numerical figure for the degree of lunulation at any site or area, the higher the figure the better the lunulation and vice-versa. *Crassilunulata* and *Parvilunulata* were descriptive words coined by Jarvis for well and poorly lunulated specimens respectively. The figure for *agestis* colonies is five minimum.

The colony at Hart Warren is the most southerly of those on the Durham coast, and is relatively sheltered. At Castle Eden Dene it is much more exposed. Why should the Hart Warren colony be so poorly lunulated? – it should be at least as well lunulated as those further north along the coast, but this is not the case. Move all of 17km inland to Sherburn Hill and a totally different lunulation pattern is encountered. At CC:CP=1.74 it has the highest figure of all the various *salmacis* colonies. It is submitted that total site aspects cannot account for the lack of variation at the Peak District and Yorkshire Wolds sites, and at the same time a vast variation at two sites relatively close together in Durham. One point should be made here concerning photoperiods. This is not necessarily pertinent to the present discussion, but may prove important on a wider front. For the two most divergent examples of lunulation in Durham these must be virtually identical. This means that quoting photoperiods as a limiting factor cannot be a valid point in discussing migration. At the end of the day changes have occurred, and even if there were any initial photoperiod problems, these have been overcome. To revert to "total site aspects", they have not had a large enough impact on Peak District colonies to cut out 6-lunule or increase 0-lunule specimens. The factors controlling phased emergence have to be much more important than "total site aspects" in the case of the Brown Argus.

Species and Sub-species

Turning now to aspects of sub-species and nomenclature, the Scottish sub-species *A. artaxerxes artaxerxes* has three main morphological characteristics; the upper forewing discal spot is white, pupilation on the underwings is lacking in most specimens, and lunulation varies. It is known that occasional "whitespots" can occur in central and southern England, also southern Sweden (Higgins and Riley, 1970). What occurs in southern English counties is a Mendelian distribution of white scales in the upper forewing discal spot ranging from a complete absence in 70% of males and 36% of females, through small numbers to a point where the centre is circled with white (var. *albiannulata*) and onwards to the occasional whitespot. The most simple explanation for this is that all white scales stem from *artaxerxes* and that there is a diminishing *artaxerxes* presence radiating from Scotland southwards to southern England and eastwards to southern Sweden. When underside spots are examined the situation is less easy to quantify. Over 80% of specimens from the Aberdeen area showed no pupilation to the naked eye. However with a hand lens significant numbers of dark scales were noted in

the centres of spots in all specimens examined. This mirrors the occurrence of dark scales in the mainly white discal spots. When specimens from north Lancashire, the Peak District and the Isle of Wight were examined, the pupilation (measured by the dark centre as a percentage diameter of a spot and averaged out) increased only slowly from north to south (40 to 50+%). Even in the Isle of Wight the average was only a little over 50%, and since 50% linear is 25% by area, the white scales accounted for c70% and were in a comfortable majority. This is merely a straw in the wind, but it points in the same direction as other aspects mentioned, rather than against them. It may also point to a greater *artaxerxes* content than hitherto suspected.

In south-west and south-east Scotland the lunulation has increased to a point where it is very similar to that in Castle Eden Dene (the classical *salmacis* site) and north Lancashire SD47, and is distinctly greater than at Hart Warren. In any one *artaxerxes* specimen there will be an intermingling of all three characteristics, but they must be in some sort of equilibrium. If lunulation is regarded as the dominant morphological factor in view of phased emergence detailed above there is a case for including southern Scotland in *salmacis*. Shreeve has criticised the publication of a map (Smyllie, 1992a) which includes zones described as "*agestis* + low% *artaxerxes*", "*artaxerxes* + low% *agestis*" and "*artaxerxes* + significant percentages of *agestis*" with the comment that they are both good species. From his point of view this criticism is valid. However in a paper highlighting what is considered to be interpenetration on a scale not previously recorded, it is reasonable to draw attention to the component parts of "species". Take the case of *agestis*. There is a difference between *agestis* in southern England, and what is also described as *agestis* across the Channel in France. This difference consists in the presence and absence respectively of varying numbers of white scales in the discal spots described above. Which of the two is the more genuine *agestis*? They are certainly not identical. The complications with *artaxerxes* have already been referred to. There is probably no simple answer, and there is room for differing viewpoints in a complex situation. The contention (Smyllie, 1995) that both *artaxerxes* and *salmacis* consist of a range of intermediates between *allous* and *agestis, ie* a range of hybrids, remains in place. This might be called a cline, but "intermediates" is favoured because of the dappled situation particularly in Durham. In this situation *artaxerxes* was formed from *allous* by an event which created white discal spots particularly on the upper forewing, and also removed pupilation from underwing spots. Subsequent interpenetration has given rise to Mendelian distributions in upper forewing lunulation, discal spot white scales in *agestis,* discal spot dark scales in *artaxerxes,* and underwing spot pupilation.

References

Dennis, R.L.H. & Shreeve, T.G., 1989. Butterfly morphology variation in the British Isles: the influence of climate, behavioural posture and the host-plant habitat. *Biological Journal of the Linean Society,* **38**: 323-348.

Higgins, L.G. & Riley, N.D., 1970. *A Field Guide to the Butterflies of Britain and Europe*. Collins, 282.

Høegh-Guldberg, O., 1966. North European Groups of *Aricia allous* G.Hb. Their Variability and Relation to *A. agestis* Schiff. *Natura Jutlandica* **13**.

Jarvis, F.V.L., 1969. A Biological Study of *Aricia artaxerxes* ssp. *salmacis* (Stephens). *Proceedings British Entomological & Natural History Society*: 107-117.

Shreeve, T.G., 1993. Confusing the geographic variation within species of *Aricia* for hybridisation. *The Entomologist* **112** (2), 75-80.

Smyllie, B., 1992a. The Brown Argus Butterfly in Britain – a Range of *Aricia* Hybrids. *The Entomologist* **111**: 27-37.

– , 1992b. The Brown Argus Butterfly in Britain with Particular Reference to the Peak District. *The Sorby Record* No 29: 2-17 + plates.

– , 1993. Brown Argus: 1992 Field Study Backs Hybrid Theory. *Butterfly Conservation News* **53**: 24-25.

– , 1995. The Brown Argus Butterfly in NW Europe. *Entomologist's Rec. J. Var.* **107**: 15-24.

The rise and fall of melanic Peppered Moths *Biston betularia* L. (Lep.: Geometridae)

The rise and fall in frequency of melanic (form *carbonaria* Jordan) Peppered Moths, *Biston betularia* Linn., is one of the best documented examples of observable evolutionary change. Melanic frequencies of 90% or more were recorded in and around areas of heavy industry and were maintained at this level until the late 1970s when a decrease in frequency began. The decrease has continued and at one site a melanic frequency of over 90% in 1959 has fallen to less than 18% in 1995. Similar changes have occurred and are still occurring in the American subspecies, *Biston betularia cognataria*. Indeed the melanic form may be decreasing at a rate of 1-2% a year which means that it will disappear unless some sort of stability occurs.

Because of the exceptional interest of evolution in the Peppered Moth, I suggest that in 1996 a special effort is made to record the frequencies of all three forms: typical, *carbonaria* and the intermediate *insularia* Thierry-Mieg. We need information from as many sites as possible from throughout the British Isles. The moth is readily caught in m.v. and similar traps. Many of us run traps in our gardens and it is from these that the best records are likely to be obtained as sample sizes should be adequate for numerical analysis.

I would be delighted to receive records from the 1996 season, either in the form of a list of frequencies of typicals, *carbonaria* and *insularia*, or papered specimens which I can then score. In this way we should be able to build up a picture of the present status of melanism in the Peppered Moth which can be compared with the past situation. If left much longer, it may be too late. I look forward to hearing from moth trappers prepared to participate in this project in 1996.– Denis F. Owen, 42 Little Wittenham Road, Long Wittenham, Abingdon, Oxfordshire OX14 4QS.